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Abstract

**UNDERGROUND CONTAINMENT FOR THE EXPERIMENTAL
NUCLEAR POWER STATION LUCENS**

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The 30 MWth experimental nuclear power station presently under construction at Lucens is equipped with a pressure-tube reactor, moderated by heavy water and cooled by carbon dioxide.

In view of the underground location of the plant an economic design for the containment was developed using conventional civil engineering construction techniques while taking advantage of the natural properties of the surrounding rock. Such design provides sufficient protection even in the event of the maximum hypothetical accident.

Extensive investigations on the geology and hydrology of the site have shown that the rock mass, a porous homogeneous and highly compact molasse, typical of sedimentary configuration, can be used as a filter for particulate radioactivity as well as temporary storage for fission gases released after a severe accident without undue risk to the surroundings.

With the help of laboratory tests and measurements carried out in an experimental cavern excavated on the site the various mechanisms governing de-compression of the containment and release of gases to the rock could be investigated. Likewise, the techniques required for building and lining the containment could be established.

The additional lining of the entire reactor cavern, consisting of a multi-layer coating of bitumen and thin aluminium foils, will contain the initial

effects of a severe reactor accident. The resulting overpressure will be partly reduced through cooling effects and condensation of steam. The remaining overpressure is then reduced by opening decompression valves equipped with filters which will release the contained gases (mainly CO₂, air, noble gases and halogen vapours) into the surrounding porous rock. Therefore the potential danger entailed by a highly contaminated atmosphere under pressure is greatly diminished.

The tests in the experimental cavern have shown that during decompression gases will flow only a limited distance into the rock; further progression is very slow and occurs by molecular diffusion.

Based on experimental evidence the present paper then shows that containment safety requirements can be met by adequately combining the inherent site characteristics and construction techniques.